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(12) **United States Patent**
**Butterworth**

(10) **Patent No.: US 6,877,689 B2**
(45) **Date of Patent: Apr. 12, 2005**

(54) **REWINDER APPARATUS AND METHOD**

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(73) Assignee: **C.G. Bretting Mfg. Co., Inc.**, Ashland, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 88 days.

(21) Appl. No.: **10/259,163**

(22) Filed: **Sep. 27, 2002**

(65) **Prior Publication Data**

US 2004/0061021 A1 Apr. 1, 2004

(51) **Int. Cl.**[7] ................................................ **B65H 18/14**
(52) **U.S. Cl.** ................................ **242/542.1**; 242/533.1
(58) **Field of Search** ............................ 242/521, 532.2, 242/533, 533.7, 541, 541.2, 542, 542.1, 542.2

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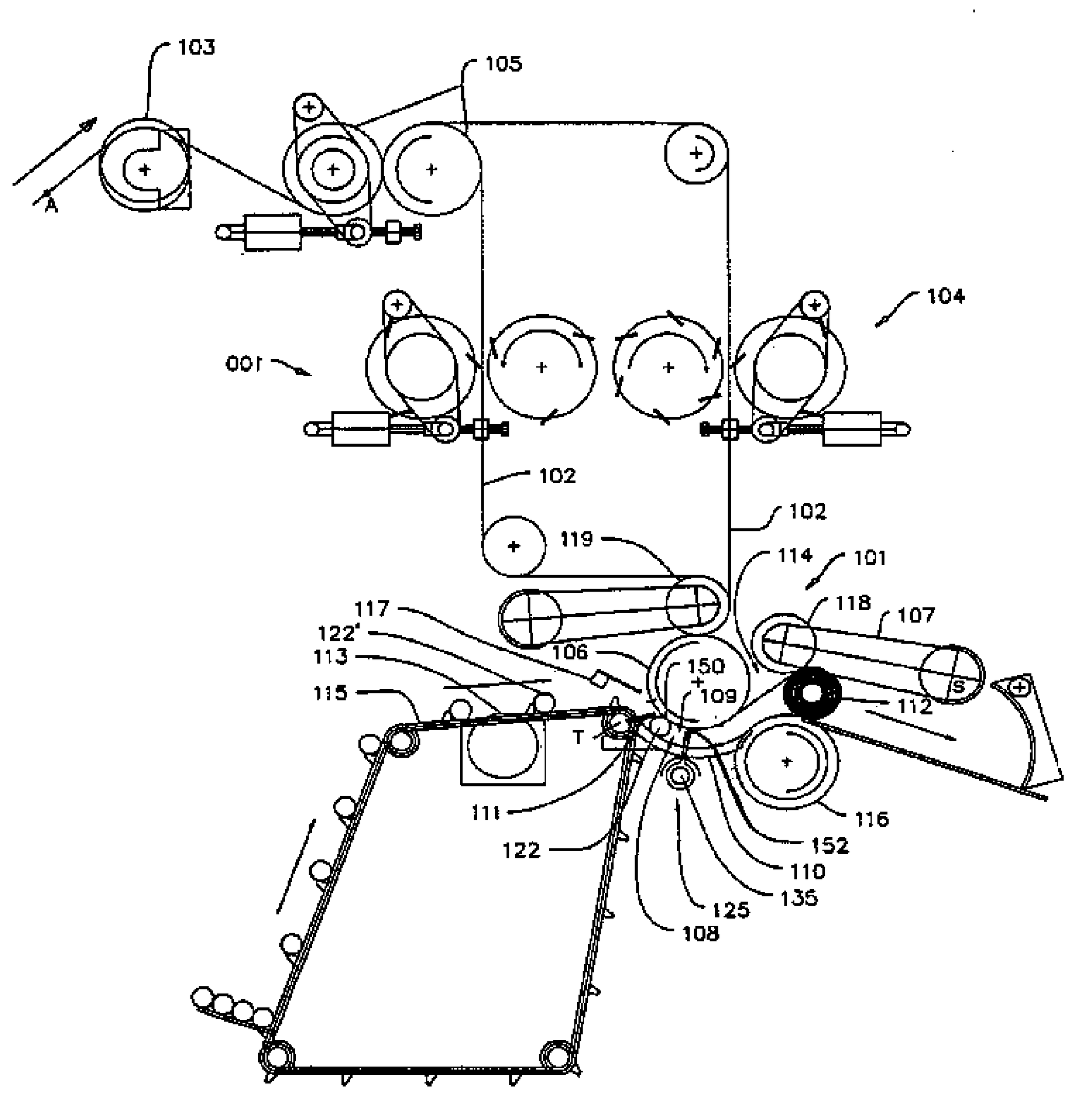
(57) **ABSTRACT**

A rewinder having a first winding roll that transports and supports the web, at least one core support plate that is curved for receiving and guiding cores adjacent the first winding roll, and a web separator adjacent the first winding roll and movable into pressing relationship with the web at a velocity at least equal to that of the web. The rewinder of exemplary embodiments winds a web of material a nip defined by the first winding roll, a second winding roll and a rider roll. The web separator of exemplary embodiments comprises a rotatable plurality of fingers that rotates about a common shaft. Because the web separator contacts the web moving at a velocity at least equal to that of the web, the web is effectively separated upstream of the web separator, between the core and the web separator.

**64 Claims, 13 Drawing Sheets**



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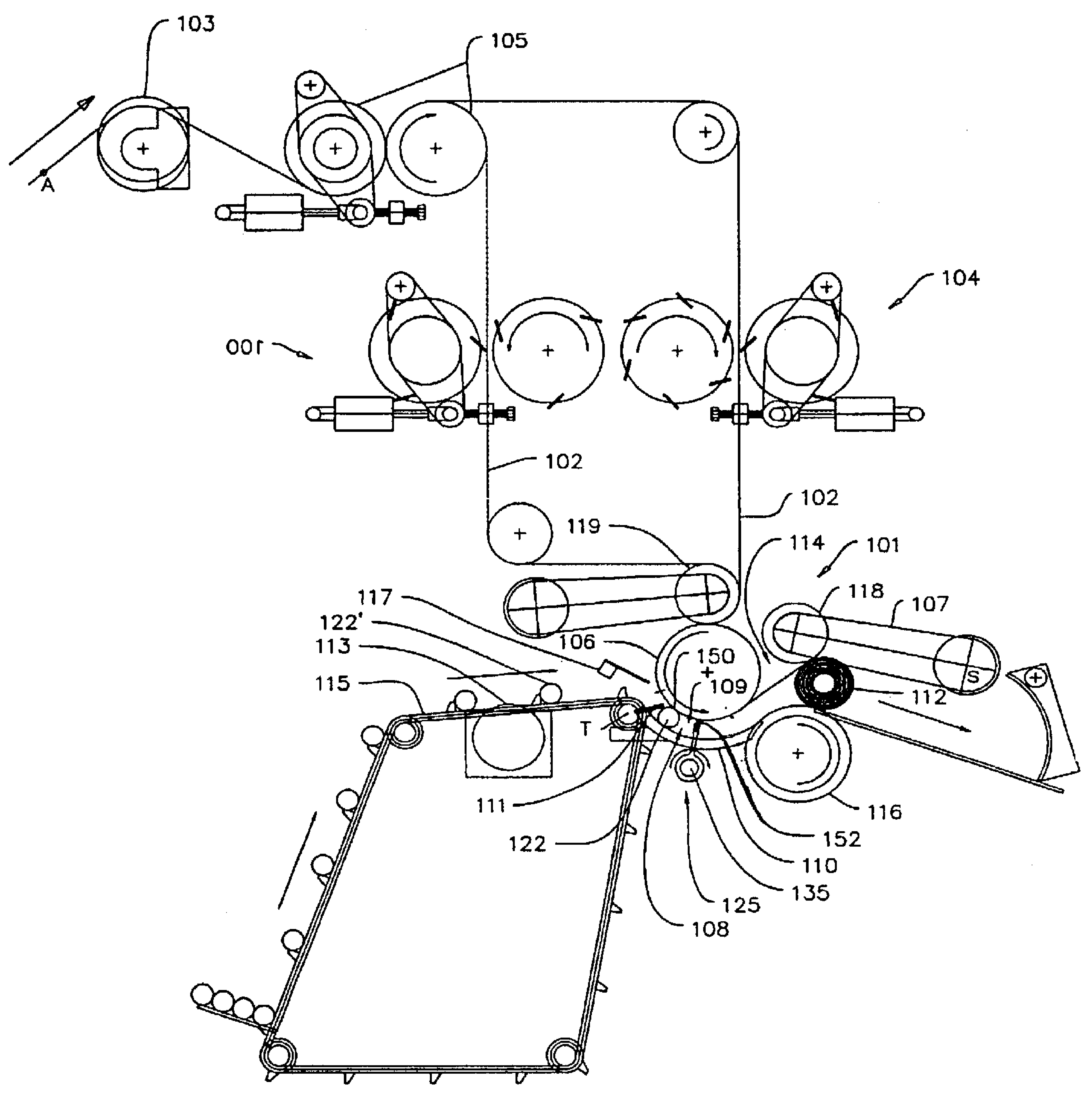
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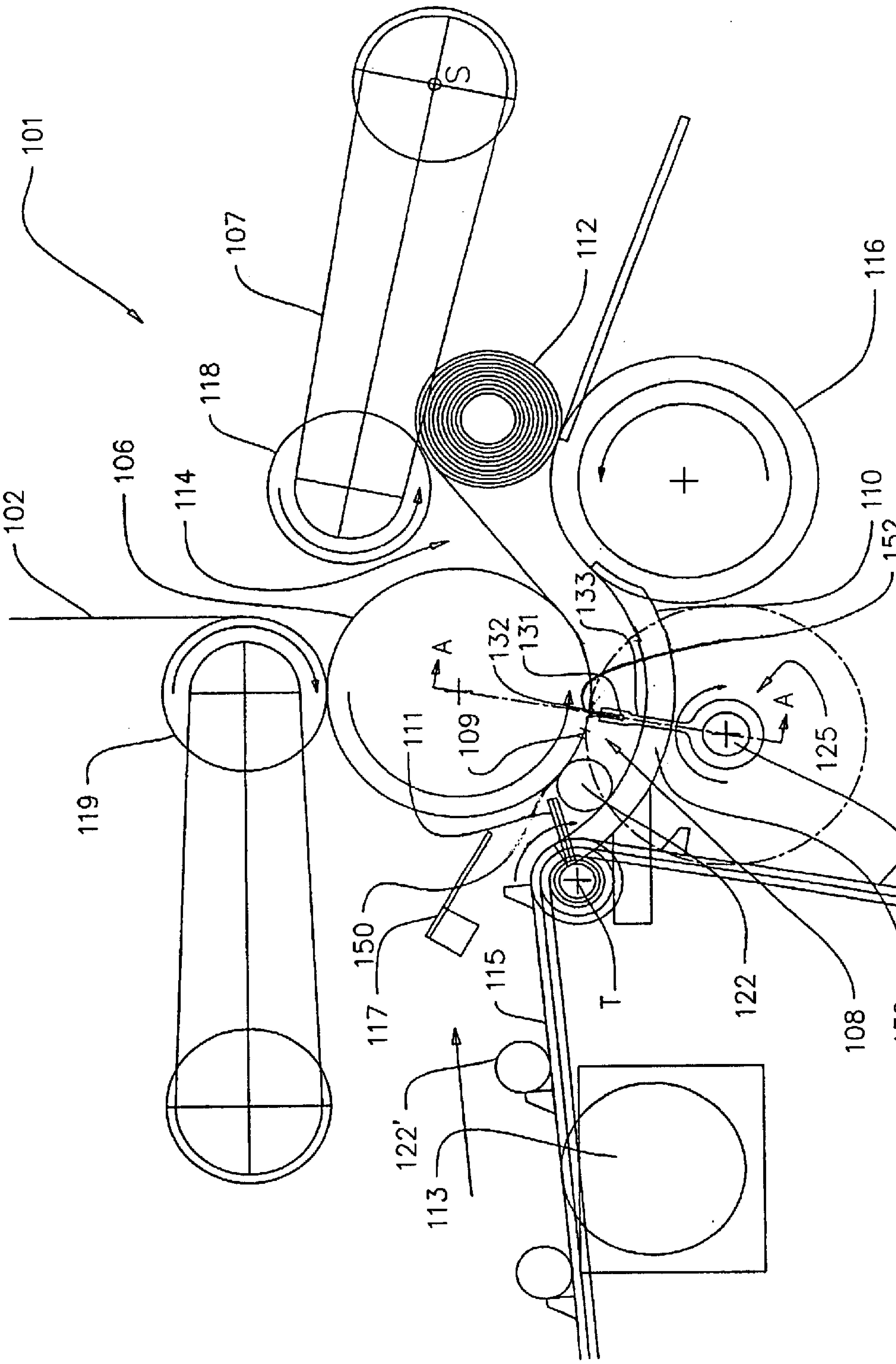
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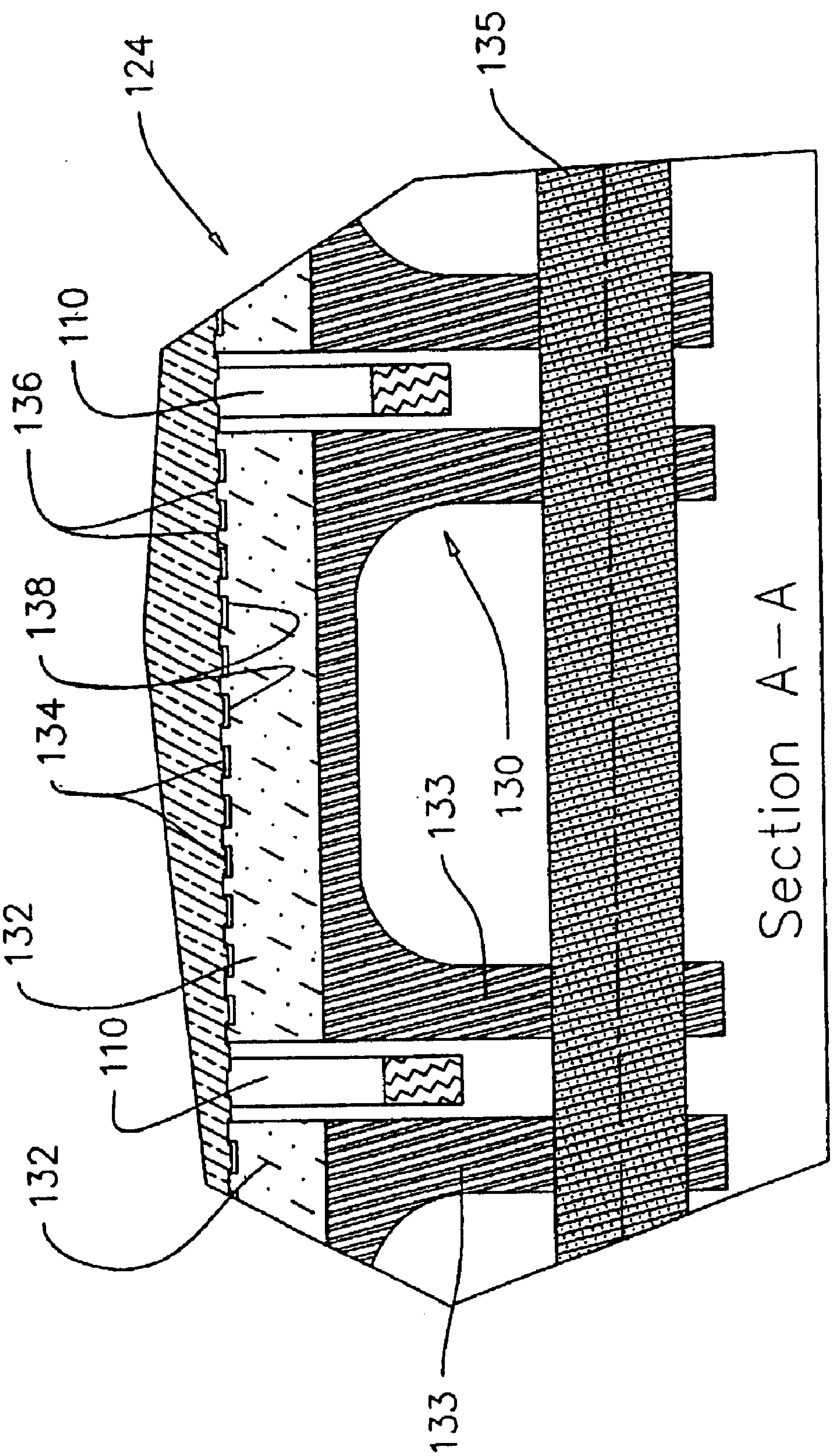


Section A–A

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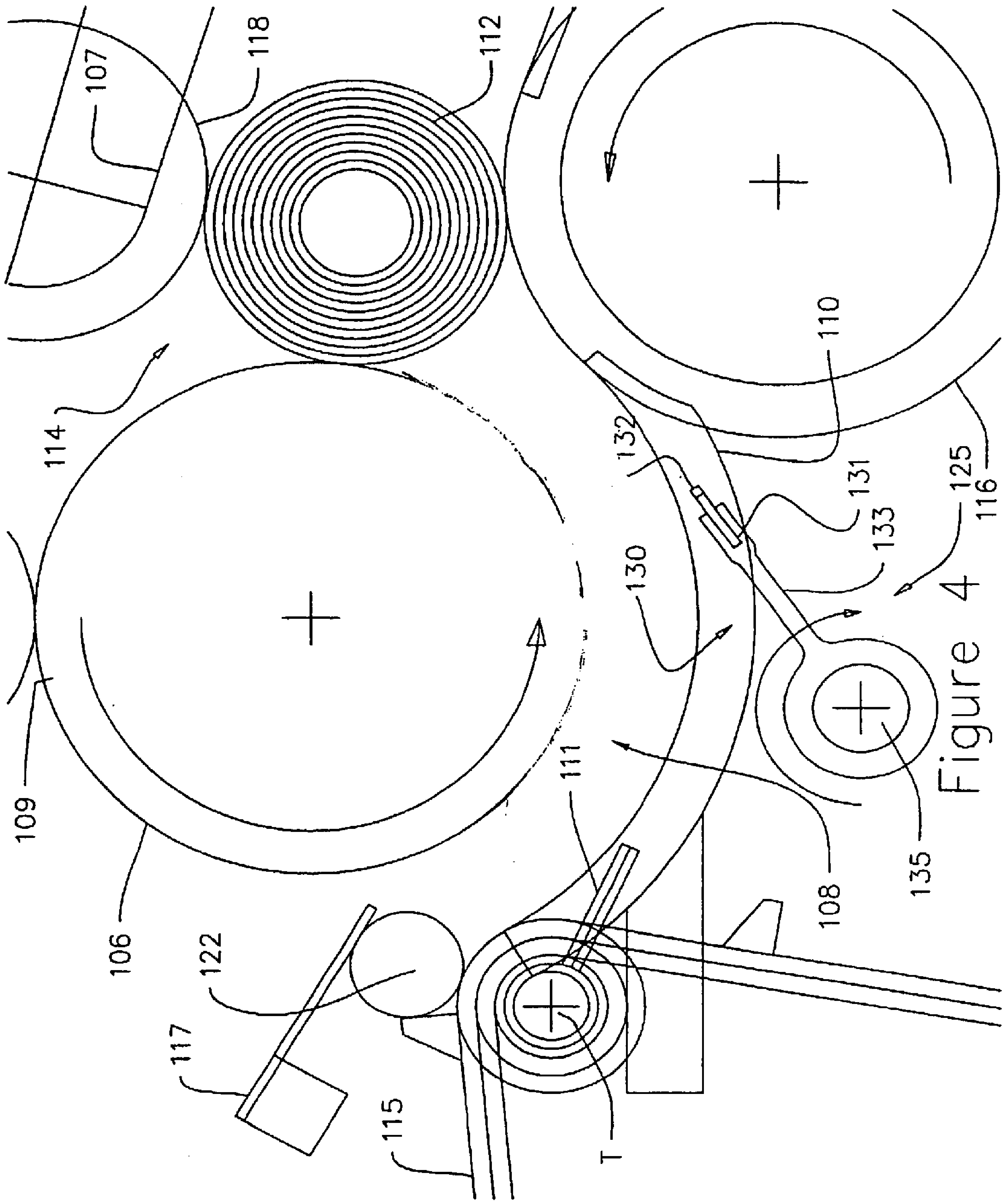
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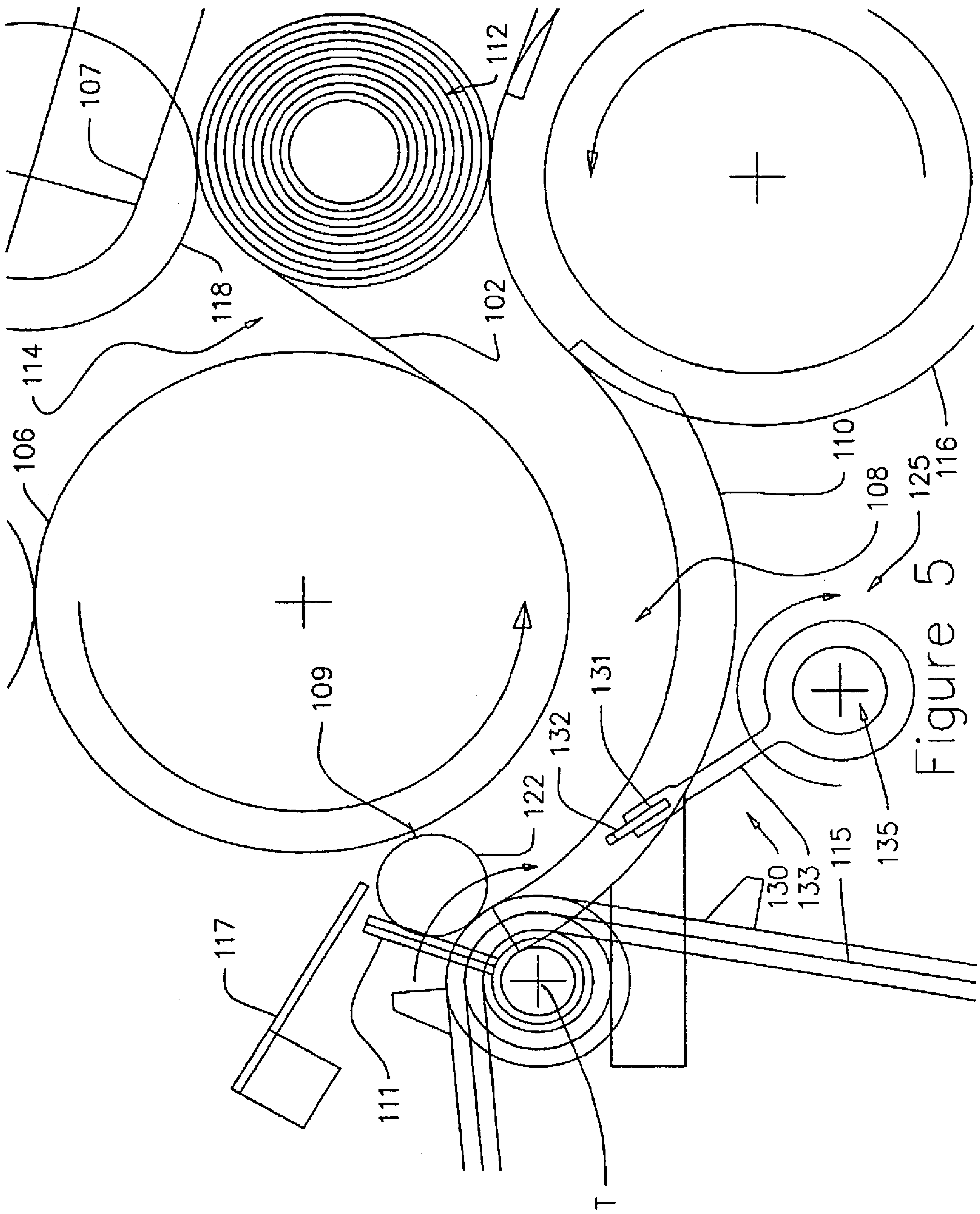

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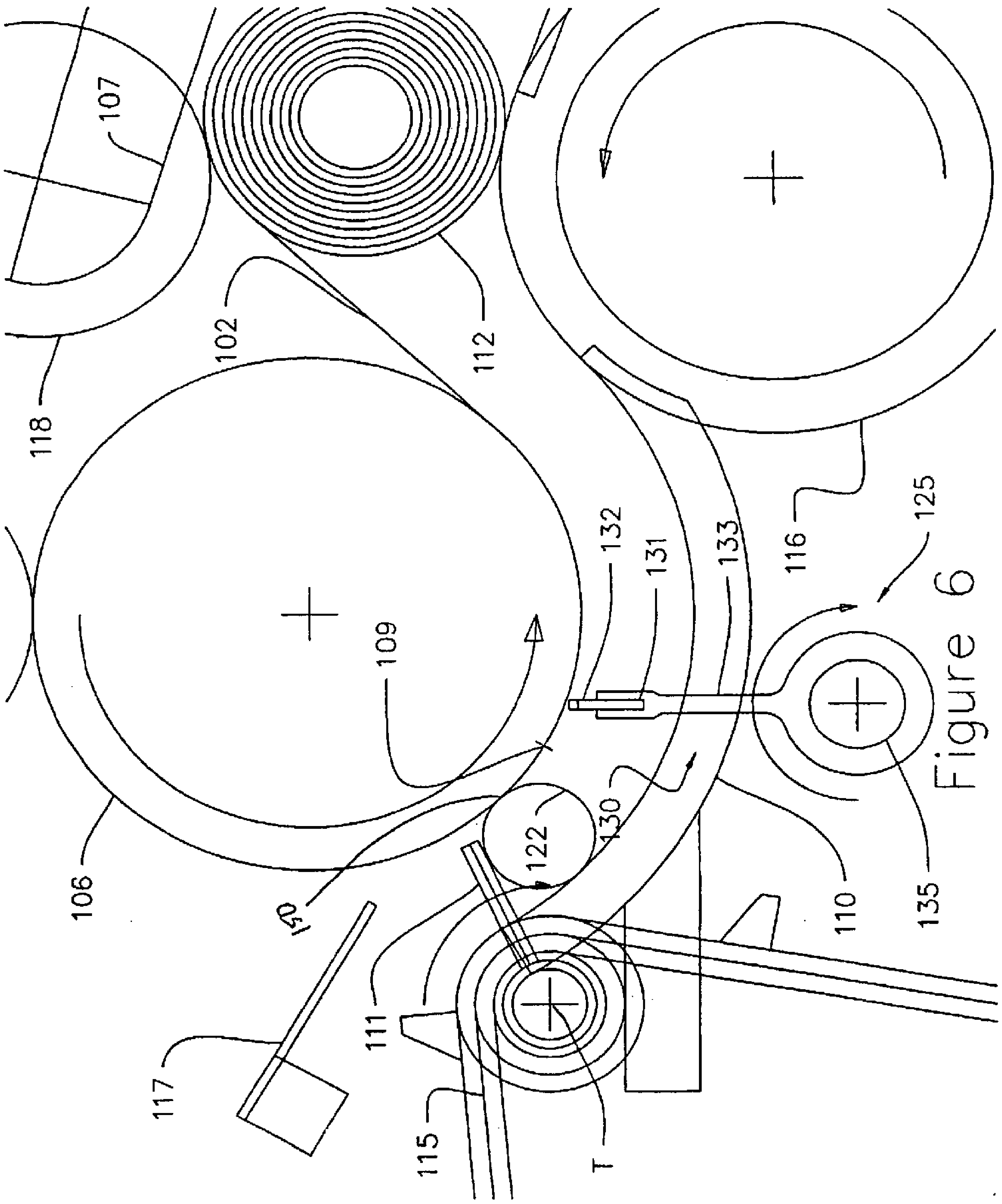
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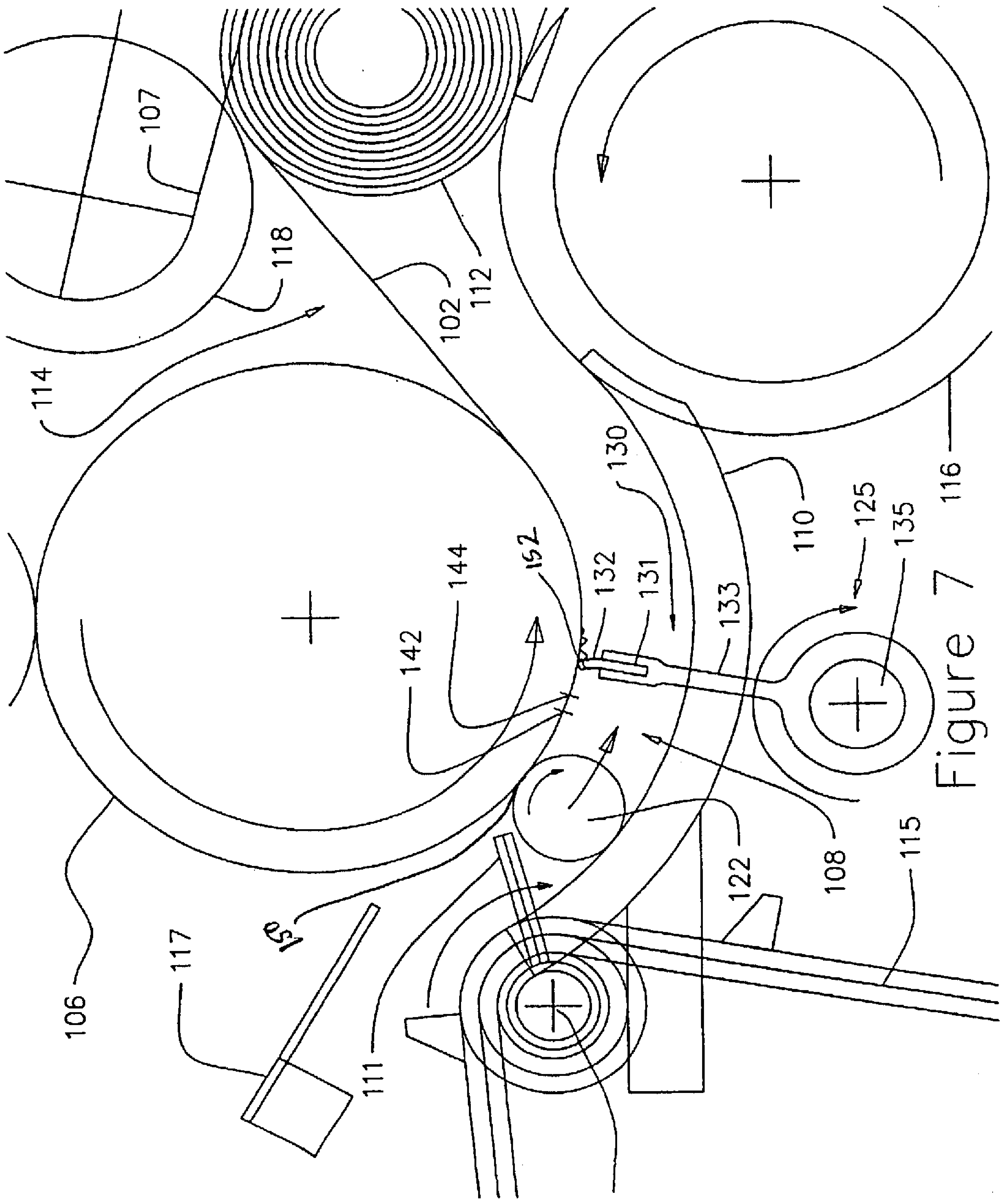
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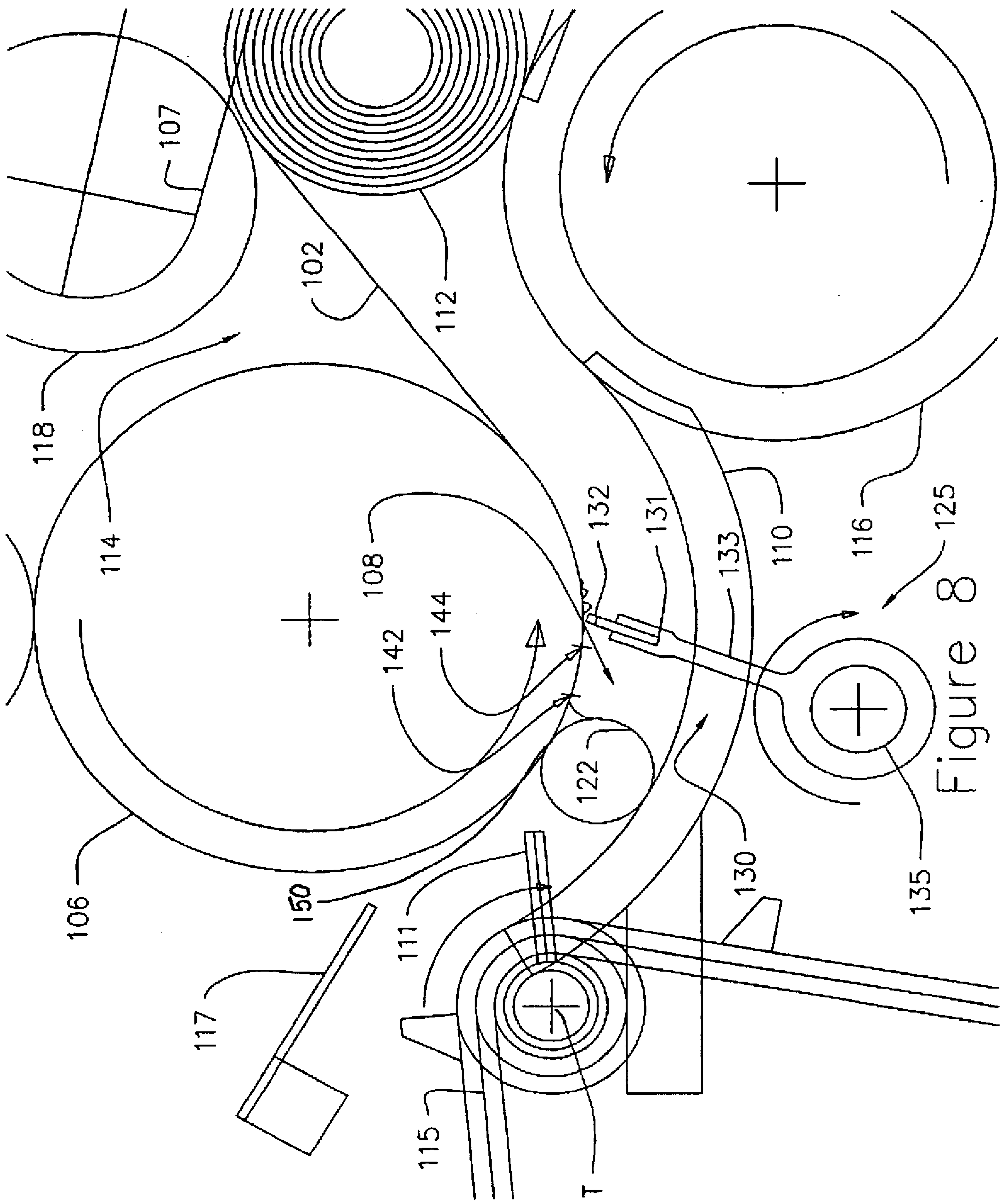
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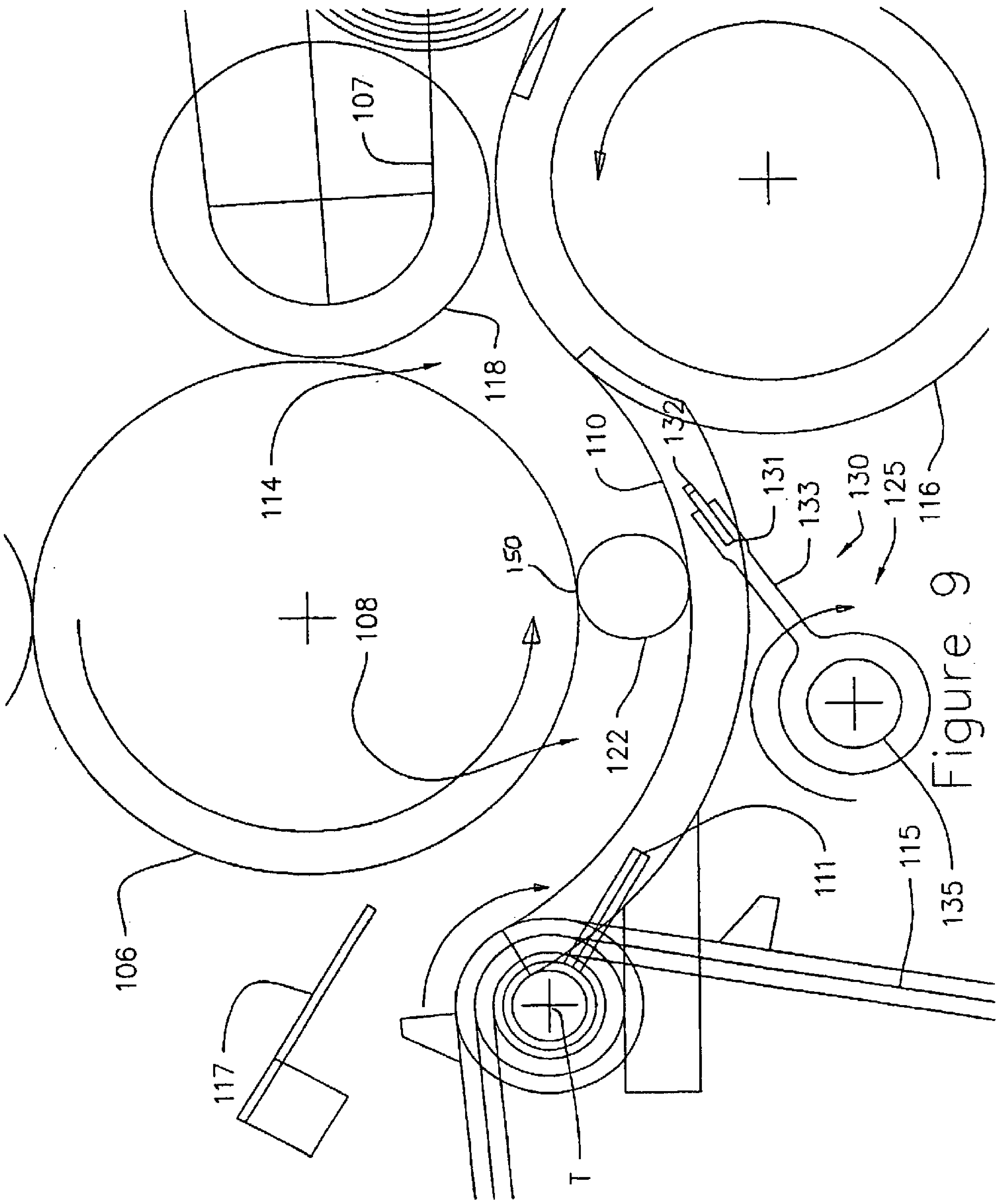
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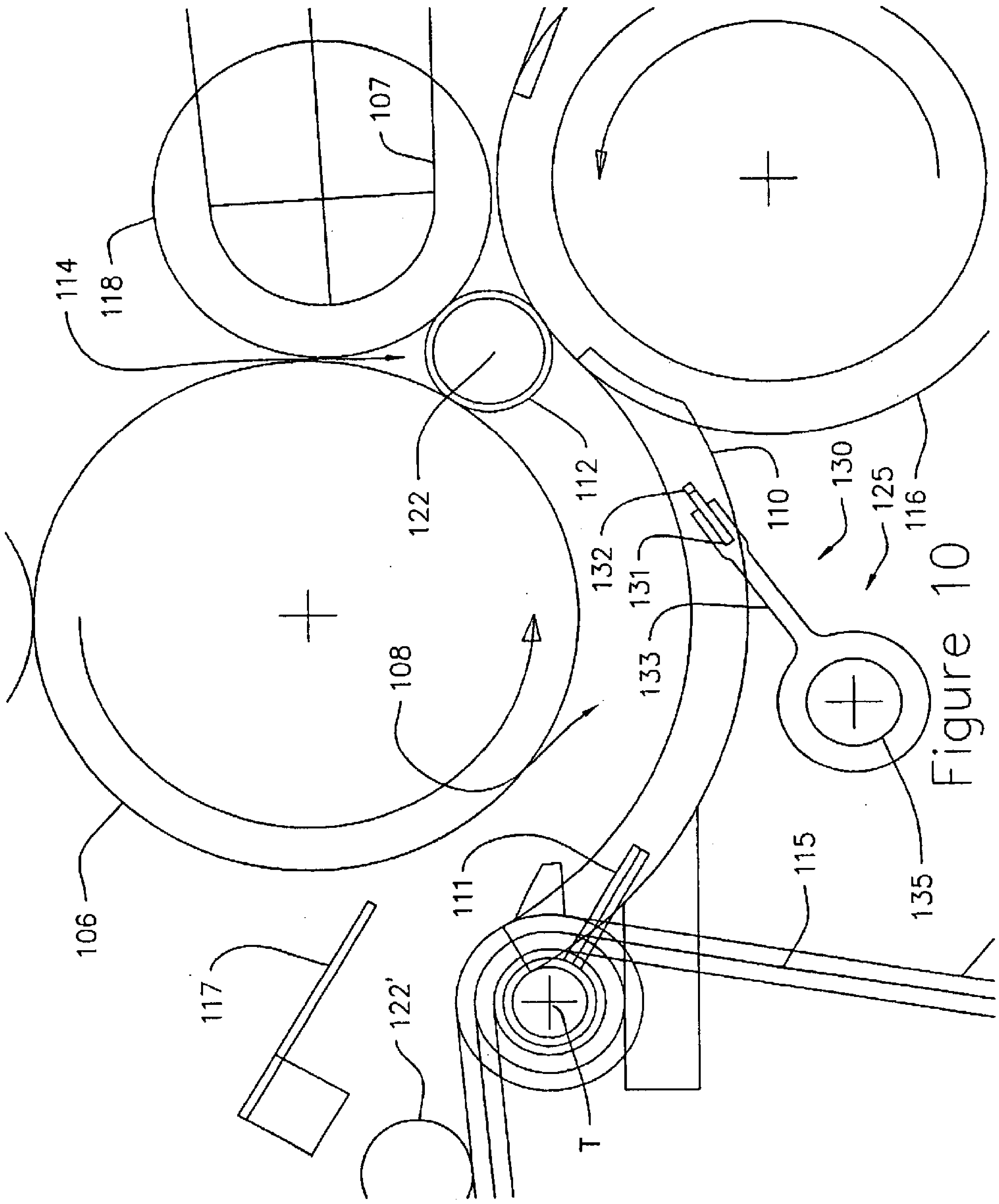
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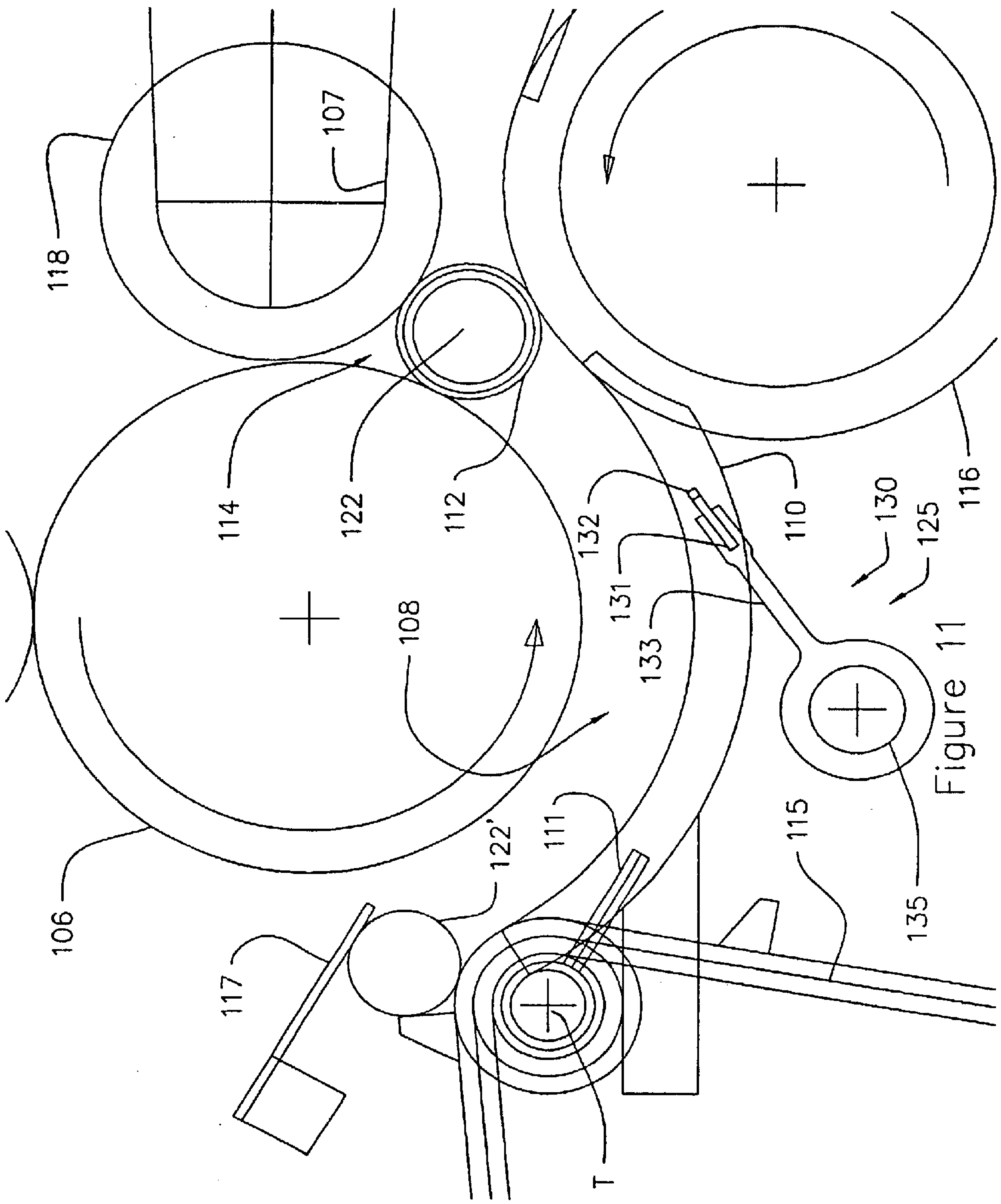

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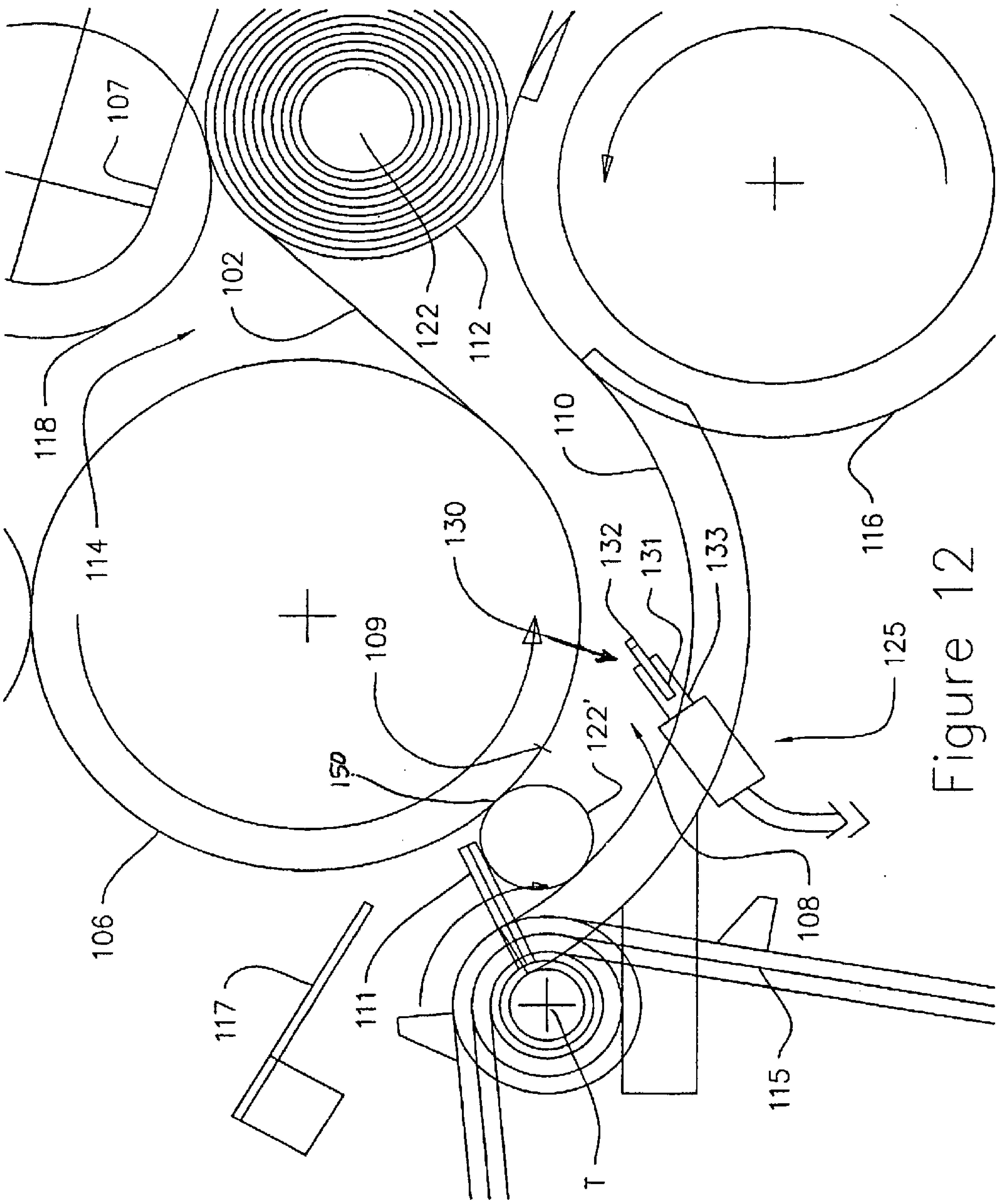
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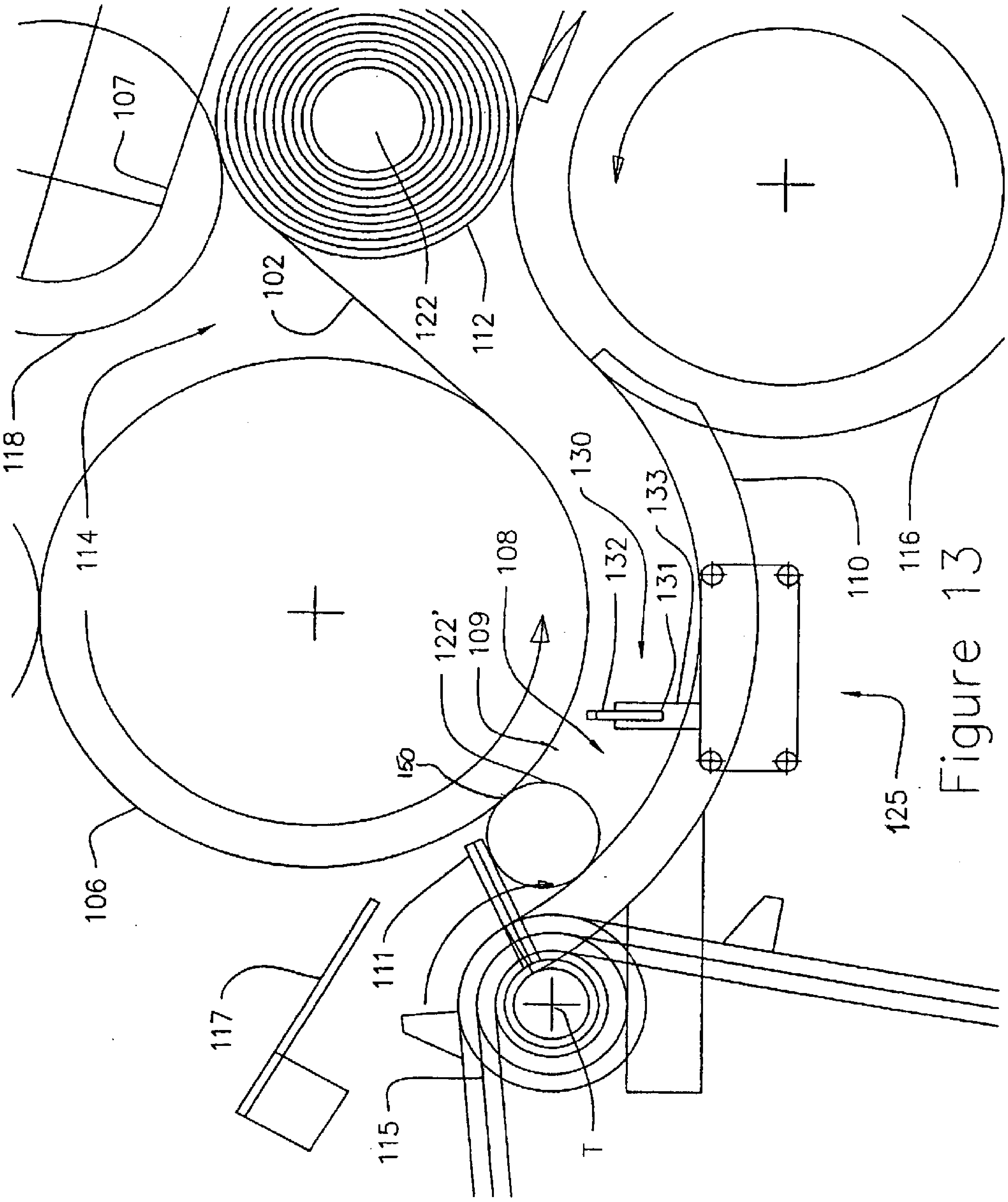
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Figure 13

## REWINDER APPARATUS AND METHOD

### BACKGROUND OF THE INVENTION

Significant developments in web rewinding have placed ever-increasing product output demands upon web rewinders. Conventional web rewinders are capable of winding a roll or "log" of material in seconds, with maximum winding speeds determined by the strength and other properties of the web and the core upon which the web is wound. Such rewinders are generally limited in their ability to control the position and movement of cores through the rewinder nip, and therefore have limited control over web separation (where cores or core insertion devices perform web separation) and web transfer to new cores. As used hereinafter and in the appended claims, the term "nip" refers to an area between two winding elements, such as between two winding rolls, a winding roll and conveyor belt, two facing conveyor belts, or other elements known to those skilled in the art used to rotate and wind a log therebetween. The nip can include an area disposed from the narrowest point between two winding elements, such as when a three-roll winding cradle is employed. The term "web" as used herein and in the appended claims means any material (including without limitation paper, metal, plastic, rubber or synthetic material, fabric, and the like) which can be or is found in sheet form (including without limitation tissue, paper toweling, napkins, foils, wrapping paper, food wrap, woven and non-woven cloth or textiles, and the like). The term "web" does not indicate or imply any particular shape, size, length, width, or thickness of the material. Although faster rewinding speeds are desired, a number of problems arise in conventional rewinders when their maximum speeds are approached, reached, and exceeded. Specifically, the position and orientation of cores entering the winding nip is important to proper web transfer and web separation, but is often variable especially at high rewinder speeds. In some rewinders, a rewinder element separates the web either by pinching the web (thereby creating sufficient web tension between the pinch point and the downstream winding roll to break the web) or by cutting the web. The position and orientation of the core in such rewinders is important to ensuring that the newly-separated web begins to wrap around the core without wrinkling or web damage.

In many conventional rewinders, the web is separated into a trailing edge and a leading edge by a web separating device once the rewound log reaches a predetermined size or sheet count. The trailing edge of the web is wound around the nearly completed log, while the leading edge of the web is wound around a new core that has been positioned near the winding nip. The types of web separating devices vary in form, shape, type of motion and location within the rewinder. In some rewinders, the web is separated by effectively slowing or stopping the motion of the advancing web with the web separating means, thereby causing the web to separate downstream of the web separating means and upstream of the nearly completed log. This type of separation causes the web upstream of the web separating means to develop slack, thus complicating winding of the leading edge of the separated web onto a new core. This type of separation, however, can still be useful depending on the distance between the nearly completed log and the web separating means. If this distance is large relative to the distance between perforations (if a perforated web is employed) reliability and accuracy of web separation can be compromised.

In light of the limitations of the prior art described above, a need exists for an apparatus and method for a web rewinder in which sufficient core control is maintained to accurately and consistently insert and guide cores toward a rewinder nip, webs can be wound at very high speeds without winding errors, web material can be properly transferred to a newly inserted core, and predictable and reliable web separation is enabled even though significantly different web materials and types are run in the rewinder. Each preferred embodiment of the present invention achieves one or more of these results.



### SUMMARY OF THE INVENTION

Some embodiments of the present invention have a first winding surface that transports and supports the web, a core support surface on which cores are guided adjacent the first winding surface toward the web, and a web separator adjacent the first winding surface and movable into and out of pressing relationship with the web at a velocity at least equal to that of the web.

Some embodiments of the present invention wind a web of material adjacent at least one of a first winding roll, a second winding roll and a rider roll, at least two of the first, second, and rider rolls defining a winding nip in the rewinder. The core is moved onto at least one core support surface and guided toward the web running into the winding nip. The web separation bar is moved toward the web at a velocity at least equal to that of a portion of the web adjacent the first winding roll and then contacts and presses the web between the web separation bar and a surface on an opposite side of the web. The web is thus separated into a leading edge and a trailing edge, and the leading edge is wound around a core or mandrel. The core, if employed, can have adhesive applied to it in a number of ways or not at all.

The first winding surface can take a number of different forms, but in some embodiments, takes the form of a winding roll that transports and supports the web. The first winding surface need not transport the web, but if employed, shall provide a surface against which the web can be pressed by the web separator in order to be separated.

The core support surface provides a surface on which cores or mandrels are accurately and consistently guided toward the winding nip, facilitating proper transfer of the leading edge of the separated web onto a new core. Although a variety of different structures can adequately be used for the core support surface in practicing the present invention, some embodiments of the present invention use a plurality of curved plates for supporting and guiding the cores or mandrels adjacent the web and toward the winding nip, in which at least one core support plate is located adjacent the first winding surface.

The web separator moves toward the web at a velocity at least equal to that of the advancing stream of web, and excellent results have been obtained by moving the web separator at a velocity 130% of that of the web. In some embodiments, the web separator comprises one or more fingers, bases and tips. A web separation bar is defined by one or more tips, which contact the web and cause it to separate. The web separator can take a number of different forms, but is shown in the illustrated embodiments to take one of three forms including a rotatable plurality of fingers with tips and bases that rotates about a common shaft; one or more fingers, tips and/or bases mounted onto a linear actuator, specifically a hydraulic or pneumatic cylinder; and one or more fingers, tips and/or bases mounted onto a conveying belt. The web separator, however, need not take any of these forms, but can simply be movable toward and away from a stream of web at a velocity at least equal to that of the web.

Because the web separator employed in the present invention moves toward the web at a velocity at least equal to that of the advancing web, the web is effectively separated upstream of the web separator, between the core and the web separator. Since the distance between the core and the web separator is controlled to be short relative to the distance between perforations in the web (if a perforated web is employed) the present invention allows for accurate, reliable and consistent web separation. Furthermore, the leading edge of the web is not wrinkled and allows for facile and accurate transfer of the leading edge of the web to a new core.

Further objects and advantages of the present invention, together with the organization and manner of operation thereof, will become apparent from the following detailed description of the invention when taken in conjunction with the accompanying drawings, wherein like elements have like numerals throughout the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is further described with reference to the accompanying drawings, which show exemplary embodiments of the present invention. However, it should be noted that the invention as disclosed in the accompanying drawings is illustrated by way of example only. The various elements and combinations of elements described below and illustrated in the drawings can be arranged and organized differently to result in embodiments which are still within the spirit and scope of the present invention.

In the drawings, wherein like reference numerals indicate like parts:

FIG. **1** is an elevational view of the rewinder according to a first preferred embodiment of the present invention;

FIG. **2** is a detail view of the rewinder illustrated in FIG. **1**, showing the first and second winding rolls, the rider roll, the core insertion device, the adhesive application area, the core support surface, and the web separator;

FIG. **3** is a cross-sectional view of the rewinder illustrated in FIGS. **1** and **2** taken along line A—A of FIG. **2**;

FIGS. **4–11** show a detail view of the winding area of FIG. **2** and the progression of events that occur in the winding area of the rewinder as a core is inserted onto the core support surface and the web is separated and wound around the core;

FIG. **12** shows a detail view of the winding area of FIG. **2** according to a second embodiment of the web separator for the present invention; and

FIG. **13** shows a detail view of the winding area of FIG. **2** according to a third embodiment of the web separator for the present invention.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring to the figures, and more particularly to FIGS. **1** and **2**, a rewinder constructed in accordance with some of the embodiments of the invention is shown generally at **100**. The rewinder **100** includes a number of stations at which various functions are performed. In some of the embodiments, a web **102** of material enters the machine by passing over a bowed roll **103** for minimizing wrinkles in the web **102**, then through a set of pull rolls **105** for controlling tension of the web **102**. In some embodiments of the present invention, the web **102** then passes through one or more perforation stations **104**. Any number of bowed rolls **103**, pull rolls **105** or perforation stations **104** can be used without departing from the present invention. Furthermore, in some embodiments of the invention, no bowed roll **103**, pull roll **105** or perforation station **104** is used. For the purpose of example only, one perforation station can be set up for the production of kitchen towels while another station can be set up for bathroom tissue. Other types of perforation stations known to those skilled in the art can be employed without departing from the present invention.

In some embodiments, the web **102** is perforated transversely at one of the perforation stations **104** and is then directed around the ironing roll **119** to a first winding roll **106**. Any number of ironing rolls **119** can be used in accordance with the present invention, including an embodiment in which no ironing rolls **119** are used. In the embodiments illustrated in FIGS. **1–13**, the web material **102** rewound and separated in this rewinder **100** is periodically perforated, but the web **102** can also be a continuous stream without perforations, or have perforations but not periodic or regular perforations.

As used herein and in the appended claims, the term "upstream" is used to describe any location, element or process that occurs prior to the point or area being referred to; whereas, the term "downstream" is used to describe any location, element or process that occurs ahead of the point or area of reference.

Any upstream equipment or elements for manufacturing, treating, modifying or preparing the web **102** before it reaches the throat **108** can be employed without departing from the present invention. The upstream elements illustrated in FIG. **1** are used only for the purpose of example.

A variety of materials can be rewound satisfactorily using the present invention. As used herein and in the appended claims the term "web" is not limited to tissue, napkin stock, and other paper product, but instead refers to any product found in sheet form, including without limitation, paper, plastic wrap, wax paper, foil, fabric, cloth, textile, and any other sheet material capable of being rewound in the rewinder **100**. However, a paper web **102** is described herein for illustrative purposes. The web **102** passes around the first winding roll **106** and into a throat **108** formed between the first winding roll **106** and at least one core support plate **110**. As shown in the illustrated embodiment of FIG. **1**, a conveyor **115** picks up cores **122** and carries them to an adhesive application area **113**. Although shown in the illustrated embodiment of FIG. **1**, the use of adhesive is not required in order to practice any embodiment of the present invention. The adhesive, if used, is applied to cores **122** by any of a variety of applicators, including a sprayer, brush, gun, syringe, device for dipping the core into adhesive, and any other similar adhesive applicator or method well-known to those skilled in the art. The conveyor **115** continues moving cores **122** to the winding area **101** of the rewinder **100**, as depicted in FIG. **2**. A core inserter **111** pushes the core **122** into the throat **108**. Other core conveyors, as described below in greater detail, that do not move cores **122** to an adhesive application area or pick up cores **122** but simply deliver cores **122** to the throat **108** can be employed without departing from the present invention. The core conveyor **115** and core inserter **111** described above are presented by way of example only.

In some embodiments of the present invention, paper logs **112** are wound in a nip **114** between the first winding roll **106**, a second winding roll **116** and a rider roll **118** as known in the art, although the invention also offers advantages in other rewinding processes, including winding the web **102** partially or fully around a core **122** in the throat **108**, winding the web **102** between two side-by-side rolls without the use of a rider roll, and any other orientation or combination of winding rolls or core support plates **110** capable of winding the web **102** around a core **122** or mandrel. If employed, the rider roll **118** is movable from a position close to the winding rolls **106**, **116** when the log **112** is relatively small to a position away from the winding rolls **106**, **116** as the diameter of the log **112** increases. Many different devices can be used to move the rider roll **118**, including a pivot arm **107** pivotable about a first axis S, an accordion-style system of bellows that is compressed as the diameter of the log **112** increases, a fixed or movable cam member with an aperture or surface upon which an extension of the rider roll **118** follows as the diameter of the log **112** increases, and any other equipment or element capable of moving the rider roll **118** away from the other rolls **106**, **116** to accommodate an increasing log **112** diameter. The pivot arm **107** and first axis S are shown in FIG. **2** only for exemplary purposes.

While roll structures are illustrated in FIGS. **1**, **2** and **4**–**13** and described herein, belts and other mechanisms, as described in greater detail below, capable of transporting the web **102** to the throat and winding the web **102** can also be used satisfactorily without departing from the present invention. For example, the web **102** can be wound around a moving belt, moving in a circular path or otherwise, instead of the first winding roll **106**.

Referring to FIGS. **1**–**13**, at least one core support plate **110** receives and guides cores **122** into and through the throat **108** toward the nip **114**, while a web separator **125** generates separation of the web **102**. The web separator **125** has one or more fingers **130**, bases **133** and tips **132**. A web separation bar **124** (see FIG. **3**) is defined by one or more tips **132** (or bases **133** if no tips **132** are used, or if the tips are integrally part of the bases). While the embodiments illustrated in FIGS. **1**–**13** use cores **122**, it will be apparent that the present invention is useful for winding coreless products using mandrels or other winding initiation devices as well. Accordingly, the disclosure herein referring to the use of the cores **122** in rewinding operations of the present invention is equally applicable to the use of mandrels in such operations.

The web separator **125** can take a number of different forms, as described below in greater detail. In the illustrated embodiment of FIG. **3**, the web separator **125** is composed of a plurality of elongated web separation fingers **130** arranged on and extending radially from a common shaft **135** that runs transversely in the rewinder **100**, but the web separator **125** can be located on any number of different shafts or other rotatable elements as desired. The fingers **130** allow for the passage of at least one core support plate **110** therebetween by providing a plurality of open spaces between each finger **130** through which at least one core support plate **110** can move. Additionally, in some embodiments, the web separation bar **124** is movable into and out of the throat **108** to contact the web **102** adjacent the first winding roll **106** at a velocity at least equal to that of a portion of the web **102** adjacent the first winding roll **106**. In some embodiments, the web separation bar **124** is mounted for rotation into and out of the throat **108**. Additionally, in some embodiments, the motion of the web separation bar **124** is generally directed clockwise with reference to FIG. **2**, but can also be directed counterclockwise with reference to FIG. **2**, or intermittently clockwise, then counterclockwise, or vice versa, or can be rotated, pivoted, or moved in any other manner to bring the web separation bar **124** into contact with the web **102** at a greater velocity than the portion of the web **102** adjacent the first winding roll **106**.

As shown in FIG. **6**, at least one resilient tip **132** of the web separation bar **124** on a base **133** (or base **133** if no tip is used, or if the tip is integrally part of the base) pinches the web **102** between the resilient tip **132** and the first winding roll **106** downstream of the core **122**. The one or more tips **132** can comprise a variety of resilient or rigid materials. In some embodiments, the tip **132** comprises polyurethane having a durometer of between sixty and one hundred, although other materials, such as polyurethane having a durometer outside of the aforementioned range, rubber, silicone, ultra-high molecular weight poly(ethylene), aluminum, steel, and any other material capable of contacting and separating the web **102** can also be employed without departing from the present invention. Furthermore, the tip can be mounted to a base **133** of the web separator **125** in any manner. The tip **132** can be mounted directly to the base **133** as illustrated in FIGS. **1**, **2** and **4**–**11** by placing the tip **132** inside a recess **131** in the base **133** and bolting the tip **132** in place, or by having one side of the base **133** removable and bolted back in place over the tip **132** capturing the tip in the recess **131**, or by clamping the base **133** closed over the tip **132** either with additional clamps or by having the base **133** itself function as the clamp, or by fitting the tip **132** into the recess **131** of the base **133** with a snap-fit between at least one rib on the tip and at least one groove in the recess **131** of the base **133**, or by defining the entire web separation finger **130** with the tip **132**, provided a sufficiently durable material is used.

Alternatively, the tip **132** can be spring mounted to the base **133** to provide resilience. For example, a variety of materials can be coupled between the tip **132** and the base **133**, including without limitation one or more compression springs, one or more blocks and/or layers of rubber, polyurethane, silicone, and any other material capable of providing resilience to the tip **132**. The resilient nature of the tip **132** in some embodiments enables tolerances for the interference between the first winding roll **106** and the tip **132** to be less restrictive while maintaining product quality and performance.

In some embodiments, the one or more resilient tips **132** of the web separation bar **124** travel through a circular path, represented by a dash-dot circle in FIG. **2**, intersecting or tangent to the path traveled by the advancing stream of web. In some embodiments, the web separation fingers **130** are arranged on a common shaft **135** running transversely in the rewinder **100**, but can be located on any number of different shafts or other rotatable elements as desired. In other embodiments, the one or more resilient tips **132** of the web separation bar **124** travel through a non-circular path, such as a path that is substantially triangular, rectangular, square, straight, arcuate, and the like. It will be apparent to one of ordinary skill in the art that any path shape can be used, provided the one or more resilient tips **132** contact the web at the desired location.

FIG. **3** shows that the first winding roll **106** of the illustrated embodiments comprises alternating annular rings of a high friction surface **134** and a low friction surface **136** spaced transversely; that is, some rings have a higher coefficient of friction than others. The annular rings of the first winding roll **106** can be arranged in any pattern, but the rings are shown as alternating rings of high friction surface **134** and a low friction surface **136** for the purpose of example only. However, any ratio of high to low friction surface areas across the roll can be used. The high friction surfaces **134** are shown as ridges for clarity in the exemplary embodiment illustrated in FIG. **3**, although in some embodiments the high friction surfaces **134** would be raised only slightly above that of the low friction surfaces **136**. One or more of a number of different materials can be used for the high friction surfaces **134**, including without limitation emery cloth; rubber; polyurethane; any knurled or embossed surface; unpolished wood, natural or otherwise, and any other material with a higher coefficient of friction than the material used on other rings of the first winding roll **106**. Similarly, one or more of a number of different materials can be used for low friction surfaces, including without limitation poly tetrafluoroethylene (PTFE); ultra-high molecular weight polyethylene; polished steel; aluminum; silicone; polished wood, natural or otherwise; and any material with a lower coefficient of friction than the accompanying higher friction surface material chosen. Thus, any combination of materials can be used for the annular rings on the first winding roll **106** where the materials chosen for some of the rings have a higher coefficient of friction than the materials chosen for the other rings.

In some embodiments of the present invention, the one or more resilient tips **132** of the web separation bar **124** comprise recessed areas **138** to prevent contact of the one or more resilient tips **132** with the high friction surfaces **134** of the first winding roll **106**. Although FIG. **3** illustrates an embodiment where the tips **132** have recesses **138** to accommodate the high friction surfaces **134**, tips **132** with no recesses **138** or tips **132** with recesses **138** that do not accommodate the high friction surfaces **134** of the first winding roll **106** are also well within the spirit and scope of the present invention. Upon intersecting the path of the web **102**, which is advancing adjacent the first winding roll **106**, as shown in FIGS. **1–13**, the web separation bar **124** contacts the web **102** and pinches it against the first winding roll **106** adjacent only the low friction surfaces **136**, when low friction surfaces **136** are employed. The web separation bar **124** accelerates to a velocity at least equal to that of the web adjacent the web separation bar **124** at the time of separation. In some embodiments, the web separation bar **124** is accelerated through rotation. The web separation bar **124** can be accelerated through any angle sufficient to generate any velocity at least equal to that of the velocity of the web **102** adjacent the web separation bar **124** at the time of separation. In some embodiments, the web separation bar **124** can be accelerated through 270° of rotation; however other angles through which the web separation bar **124** is accelerated are possible and fall within the spirit and scope of the present invention. By way of example only, the web separation bar **124** can be accelerated to a velocity at least 100% of that of the web adjacent the web separation bar **124**. In other embodiments, the web separation bar **124** can be accelerated to a velocity at least 125% of that of the web adjacent the web separation bar **124**. In still other embodiments, the web separation bar **124** can be accelerated to a velocity at least 150% of that of the web adjacent the web separation bar **124**. However, excellent results can often be achieved by accelerating the web separation bar **124** to a velocity at least 130% of the web adjacent the web separation bar **124**. Still, other web separation bar velocities can be used, each falling within the spirit and scope of the present invention.

In some embodiments of the present invention, the web separation bar **124** is timed to contact the web **102** at a position between perforations **109**, when a perforated web **102** is used. At the point of contact with the web separation bar **124**, the web **102** adjacent the web separation bar **124** is rapidly accelerated to the web separation bar speed and slips on the first winding roll **106** due to the high coefficient of friction between the web separation bar **124** and the web **102**. The velocity of the web **102** adjacent the first winding roll **106** and the velocity of a point on the surface of the web separation bar **124** can be the same or substantially the same for a fraction of a second to perform the functions of separating the web as described in greater detail below. However, this amount of time can be longer depending upon the speed of the first winding roll **106**, the web **102**, and the web separation bar **124** (i.e., with slower speeds of these elements). The amount of time these velocities are the same will typically depend at least partially upon the interference between the web separation bar **124** and the roll **106** and the respective velocities of the bar **124** and the roll **106**. The contact point or line between the web separation bar **124** and the web **102** adjacent the first winding roll **106** can be referred to as a web control point **152** in which the velocity of the web is positively controlled and known. In FIGS. **1**, **2** and **4–13**, the web control point **152** is shown as a region within which the web control point **152** will be located. Tension in the web **102** between the web separation bar **124** and the core **122** increases above the tensile strength of a perforation **109** in the web **102**. Because the web separation bar **124** is close to the core **122** when the web separation bar **124** contacts the web **102**, only one perforation **109** exists between the web separation bar **124** and the core **122** in some embodiments. In other embodiments, more than one perforation **109** can exist in the area between the web separation bar **124** and the core **122**. Locating at least one perforation **109** in this area of high tension helps ensure that the web **102** will separate on the at least one desired perforation **109**, unlike some winders that include a web separator **125** operating at a speed slower than that of a portion of the web adjacent the first winding roll **106**. This controlled separation of the web **102** helps guarantee that each log **112** has a desired number of sheets or has a more accurate sheet count, substantially reducing costs of surplus sheets commonly resulting from operation of prior art devices.

In some embodiments of the present invention, the core support plate **110** comprises aluminum. Other materials can be employed for the core support plate, including without limitation steel, ultra-high molecular weight poly(ethylene), or any other material capable of supporting a core **122** or mandrel as it approaches the web **102**. One or more core support plates **110** can be used in the present invention. Multiple core support plates **110** are used in the illustrated embodiments, as shown in FIG. **3**, but only one is shown in FIGS. **1**, **2** and **4–13**. In the illustrated embodiments, the rewinder **100** has multiple core support plates **110** that are curved, the set of which extends in at least part of the rewinder **100**. The multiple core support plates **110** are spaced apart sufficiently to permit one or more web separation fingers **130** to pass between adjacent plates **110** (FIG. **3**). In some embodiments, the curve of the core support plate **110** follows a portion of the first winding roll **106** concentrically and in some cases extends from the location where cores **122** are inserted into the winding area **101** to the second winding roll **116**. In some embodiments, as the core **122** is inserted onto the core support plate **110**, the core **122** is driven by the first winding roll **106** while rolling along the core support plate **110** toward the winding nip **114**. In other embodiments, the core **122** rolls freely along the core support plate **110**. In still other embodiments, the core support plate **110** takes a different form altogether and the core **122** is brought to the vicinity of the web **102** by different devices, as discussed below in greater detail. Thus, when the core **122** rolls along the core support plate **110** while being driven by the first winding roll **106**, the average velocity of the core **122** along the core support plate **110** is approximately 50% of the velocity of the web **102** adjacent the first winding roll **106**. However, when other forms of a core support plate **110** are employed, the core **122** can move toward or adjacent the web **102** at other velocities or can approach the web **102** by other devices.

In some embodiments, as shown in FIGS. **1**, **2** and **6–13**, the distance between the core support plate **110** and the surface of the first winding roll **106** is less than the diameter of the cores **122**, helping to provide proper alignment of the core **122** as it proceeds along the core support plate **110** toward the winding nip **114** and causing the core **122** to deflect slightly, in turn, providing pressure between the core **122** and the web **102** adjacent the first winding roll **106**. With continued reference to the illustrated embodiments, this pinching action between the core **122** and the web **102** forces the web **102** against the high friction surfaces **134** of the first winding roll **106**. Forcing the web **102** against the high friction surfaces **134** helps assure that the velocity of the web **102** at the point of contact with the core **122** will be the same or substantially the same as the velocity of a point on the surface of the first winding roll **106** adjacent the web **102**. The contact point or line between the core **122** and the web **102** adjacent the first winding roll **106** can be defined as a web control point **150** in which the velocity of the web **102** is positively controlled and known. In FIGS. **1**, **2** and **4–13**, the web control point **150** is shown as a region within which the web control point **150** can be located.

However, in some embodiments of the present invention, the core **122** does not press against the first winding roll **106** (with the web **102** therebetween) with sufficient force to define the web control point **150**. In other words, the web **102** is not necessarily sufficiently retained at the location of the core **122** to define a location where the speed of the web **102** is the same or substantially the same as that of the first winding roll **106**. Accordingly, in some embodiments and/or for a period of time or movement of the core, there need not necessarily be a web control point **150** at the core **122**. In these embodiments, it is not necessary for the core **122** to press against the web **102** with the force described above, because the amount of web wrap around the curved surface of the first winding roll **106** generates sufficient tension in the web **102** to separate the web **102** along a row of perforations **109** lying upstream of the point or line of contact between the web separation bar **124** and the web **102**. Furthermore, by employing embodiments in which a web control point **150** is not necessary, lighter cores **122** can be used in the rewinder **100**, and/or the cores **122** used in the rewinder **100** do not need to be compressed as much or be able to withstand as great of force while proceeding toward the winding nip **114**.

In some embodiments of the present invention, there are two web control points **150**, **152** in this rewinding process: one web control point **150** being the contact between the core **122** and the web **102** adjacent the first winding roll **106**, and another web control point **152** being the contact between the web separation bar **124** and the web **102** adjacent the first winding roll **106**. The web is stretched in the area between the two control points **150**, **152**. The amount of stretch is determined by the relative velocity difference between the two web control points **150**, **152** and the duration of contact at the web separation bar web control point **152**. The combination of velocity difference and contact duration is enough to rupture the perforation **109** located in this high-tension zone between the web control points **150**, **152**.

In some webs **102** employed in the present invention, web stretch and perforation bond strength can be highly variable. In some embodiments of the present invention, different operating conditions can be allowed by making both the relative velocity and the contact duration adjustable, helping the rewinder **100** accommodate a wide range of web materials. The web separation bar **124**, the conveyor **115** and the core inserter **111** can be driven by one or more of a number of driving devices or actuators, including without limitation programmable electric, hydraulic, or pneumatic motors, solenoids, linear actuators, and the like, driven directly or indirectly via belts and pulleys, chains and sprockets, one or more gears, and any other driving device or actuator capable of facilitating the timing of the web separation bar **124**, the conveyor **115** and the core inserter **111** and helping to ensure the presence of the desired number of perforations **109** in the zone between the two web control points **150**, **152**.

FIGS. **4–11** are detailed views of the exemplary rewinder **100** illustrated in FIGS. **1–3**, showing the progression of events in the winding area **101**. FIG. **4** shows a log **112** being wound in the winding nip **114** between the first winding roll **106**, the second winding roll **116**, and the rider roll **118**. A core **122** is positioned on the chain conveyor **115** near the entrance to the throat **108**, between the first winding roll **106** and the core support plates **110**. The conveyor **115** and core inserter **111** can be timed and the core **122** restrained from entering the throat **108** until appropriate in a number of ways, including without limitation a plate restraint **117** comprised of a sheet of material contacting the core **122** from the side, below or above (i.e. as shown in FIGS. **1**, **2**, **4–11**) that helps restrain the core **122** due to the orientation and rigidity of the plate; a door that slides, swings, rotates, or rises into position in front of the core **122**; a fence made up of a plurality of rods, pegs or plates that is oriented above, below, or beside the core **122** and slides, swings, rotates, rises up, or otherwise moves into position in front of the core **122**; and any other barricading structure or device that helps restrain the core **122** from entering the throat **108** until the appropriate time. As illustrated in FIG. **4**, the core **122**, complete with adhesive in some embodiments, is trapped between the chain conveyor **115** and the plate restraint **117**, located above the core **122** in the illustrated embodiments. A row of perforations **109** is shown just coming onto the first winding roll **106**. The web separation bar **124**, the conveyor **115** and the core inserter **111** are about to begin moving to initiate the separation and core insertion processes.

FIG. **5** shows that the log **112** has started to move away from the first winding roll **106**, initiating the discharge process. This movement can be the result of slowing down the second winding roll **116** relative to the first winding roll **106**, speeding up the first winding roll **106** relative to the second winding roll **116**, or both. The web separation bar **124** has accelerated through 270° of rotation from rest (as shown in FIG. **4**) to a tip velocity of 130% of the velocity of the web **102** adjacent the first winding roll **106**. The perforation **109** has traveled around the first winding roll **106** to a position close to the core **122**. The core inserter **111** is pushing the core **122** out from under the plate restraint **117**, toward the throat **108** and onto the core support plates **110**. In some embodiments, the core inserter **111** accelerates the core **122** to approximately 50% of the velocity of the web **102** adjacent the first winding roll **106**. The core **122** then travels along the core support plates **110** at a velocity approximately 50% of the velocity of the web adjacent the first winding roll **106**, as explained above.

FIG. **6** shows the log **112** continuing to move away from the first winding roll **106**. The core **122** has been inserted between the first winding roll **106** and the core support plates **110**, thereby forming the web control point **150** as explained above. The web separation finger tips **132** have passed through the core support plates **110** to an area between the first winding roll **106** and the core support plates **110**. The core inserter **111** and the web separation bar **124** have been timed relative to the perforation system **104** to place a single row of perforations **109** between the core **122** and web separation bar **124** adjacent the first winding roll **106**.

FIG. **7** shows the log **112** moved away from the first winding roll **106** enough to allow the rider roll **118** to drop toward the second winding roll **116**. The core **122** is driven by the first winding roll **106** and is rolling along the core support plates **110**. The separation bar **124** is in contact with the web **102** adjacent the low friction surfaces **136** of the first winding roll **106**. The web **102** at the web control point **152** is therefore rapidly accelerated to the velocity of the web separation bar **124**. This acceleration of the web **102** causes the web **102** to become slack downstream of the web separation bar **124** and to become taut upstream of the web separation bar **124**. Specifically, the web **102** stretches in the zone between the two web control points **150**, **152**, causing the web **102** to rupture into a leading edge **142** and a trailing edge **144** along the properly positioned row of perforations **109** located between the two web control points **150**, **152**.

FIG. **8** demonstrates the transfer of the leading edge **142** of the ruptured web **102** to the core **122**. In some cases, and depending upon the speed of the core **122** and the distance between the core **122** and the leading edge **142** of the ruptured web **102**, a short, controlled fold-back of the web **102** can be formed on the core **122**.

FIG. **9** shows the web separator **125** moving out of the core path and out of the area between the core support plates **110** and the first winding roll **106**. The core **122** is moving toward the winding nip **114** between the first winding roll **106**, the second winding roll **116** and the rider roll **118**. The rider roll **118** has dropped down close to the second winding roll **116**.

FIG. **10** shows a later stage in the winding process, with the core **122** in contact with the first winding roll **106**, the second winding roll **116** and the rider roll **118**.

Finally, as shown in FIG. **11**, the rider roll **118** begins to move upward as the new winding log **112'** increases in diameter. The conveyor **115** has indexed a new core **122'** into position for the next core insertion step. Winding can continue until the log **112'** nears completion, at which time the above-described process can repeat, beginning as depicted in FIG. **4**.

As best illustrated in FIGS. **1** and **2**, a conveyor **115**, a core inserter **111** and a plurality of core support plates **110** are used to insert and guide the cores **122** into the winding nip **114**. However, cores **122** can instead be inserted and/or guided to a winding nip (e.g. a two- or three-roll winding nip) via other insertion devices that are well within the spirit and scope of the present invention. For example, one or more fingers or other protrusions can extend from a ring that, when rotated, picks up cores **122** and transports them toward the winding nip **114**; a pulley system that transports cores to a location where a lever, pressurized air jet, vacuum system or other mechanism directs the core **122** into the winding nip **114**; an elevating platform that brings cores **122** toward a desired position where a lever, pressurized air jet, vacuum system or other mechanism directs cores **122** into the winding nip **114**; one or more ramps, rails, ducts, beds, gutters and the like that guide cores **122** to the winding nip **114** via gravity, a pressurized air jet, a vacuum system, or other mechanism; a series of valves within or along a ramp, rail, duct, bed, gutter and the like that indexes and advances cores **122** to the winding nip **114** by incorporating pushers or pressure gradients to force cores **122** through the valves or timers to actuate the opening and closing of the valves to allow cores **122** to move through the valves at appropriate times; a rotatable or swinging arm that transports cores **122** to the winding nip **114**; and any other inserting and guiding device or system known to those skilled in the art.



In some embodiments of the present invention, the core inserter **111** comprises one or more paddles that rotate about an axis T to push the core **122** out from under the plate restraint **117** and into the throat **108** as shown in FIGS. **1**, **2** and **4–13**. However, in other embodiments, the core inserter **111** does not rotate about an axis, but rather follows the conveying motion of the conveyor **115**, moves along an arcuate path independent from but adjacent the conveyor **115**, moves along a straight path independent from but adjacent the conveyor **115**, follows an aperture in a cam member, and/or follows any other path or moves in any other manner for moving the core **122** as described above. In some embodiments, the core inserter **111** is comprised of one or more rods, plates, fingers and/or any other element capable of pushing the core **122** into the throat **108**. In other embodiments, the core inserter **111** has one or more curved or bowed surfaces, is spherical, or has a cross-section that is trapezoidal, triangular, round, diamond-shaped, or has any other shape or cross-sectional shape. In still other embodiments, the core inserter **111** does not push the core **122** by contacting the core **122** along a longer edge of the core inserter **111**, but rather pushes the core **122** into the throat **108** by poking the core **122** with a shorter end of the inserter **111**, or pushes the core **122** in any other manner known to those skilled in the art. Accordingly, these and any other devices or structures capable of transporting and inserting cores **122** into the winding nip **114** can be employed without departing from the present invention. However, regardless of the device or system that transports cores **122** to the winding nip **114**, the web separation bar **124** of the present invention can still be employed as described above to separate the web downstream of the core **122** being inserted.

The core support surface **110**, if employed, can be any surface along which cores **122** can be guided toward the winding nip **114**. For example, the core support surface **110** can be defined by one or more sides, edges or other surfaces, of one or more plates, rods, bars or other elements extending any distance past and/or around the first winding roll, can be a sheet of material, a grid or a mesh structure, a frame of multiple elements and the like. The core support surface **110** illustrated in FIGS. **1–13** is curved, but the core support surface **110** can have a number of different forms, including without limitation flat, semicircular, and any form capable of transporting cores **122** to the web **102**. In some embodiments, the core support surface **110** is comprised of a plurality of rods with rectangular cross-sections, but the core support surface **110** can be a number of different shapes; for example, the core support surface **110** can be a solid sheet or plurality of rods, bars, plates or other elements with an ellipsoidal shape, square cross-section, circular cross-section, triangular cross-section, trapezoidal cross-section, and any other shape or cross-section known to those skilled in the art. In the embodiments illustrated in FIGS. **1–13**, the core support surface **110** is stationary, but the core support surface **110** can be movable; that is, movable only when actuated, movable by rotation, movable by swinging about a hinge, movable by sliding along a straight or arcuate path, and movable by any other devices known to those skilled in the art. In still other embodiments, the core support surface **110** can be comprised of a plurality of rods transversely spaced an equal distance apart; however, the core support surface **110** can be comprised of a plurality of sheets, plates, rods, bars or other elements and can have a number of different schemes for spacing these elements; for example, the elements can be spaced longitudinally, transversely, equally, unequally, randomly, and follow any other scheme or pattern of spacing without departing from the present invention. In yet other embodiments, the core support surface **110** is comprised of a plurality of rods oriented longitudinally (as shown in FIGS. **1–13** and especially FIG. **3**), but the core support surface **110** can be oriented with respect to the advancing web in a number of ways, including without limitation being oriented longitudinally, transversely, partially transversely and partially longitudinally, radially, and be oriented in any other manner known to those skilled in the art. In short, the core support surface **110** can comprise any other surface or plurality of surfaces capable of guiding cores **122** toward the winding nip **114**.

Although in the embodiment illustrated in FIGS. **1–11**, the web separator **125** is elongated, rotatable about an axis and comprised of a plurality of web separation fingers **130** with resilient tips **132**, the web separator **125** can take a number of different forms while still being movable toward the web **102** at a velocity at least equal to that of a portion of the web **102** adjacent the web separator **125** at the time of separation for the purpose of contacting and separating the web **102**. For example, the web separator **125** comprising one or more web separation fingers **130**, bases **133**, and/or tips **132** can be mounted to a linear actuator **154** for movement toward the web **102** along a linear path (as shown in FIG. **12**), or mounted to a conveying belt **156** equipped with one or more web separation fingers **130**, paddles, or other protrustions, bases **133** and/or tips **132** (as shown in FIG. **13**). Many types of linear actuators can be employed, including without limitation a solenoid, hydraulic or pneumatic cylinder, magnetic rail, and the like. In the embodiment shown in FIG. **12**, the linear actuator **154** is oriented at an angle of approximately 30° with respect to the advancing stream of web **102**; however, the linear actuator **154** can be oriented at any possible angle with respect to the web **102** so as to contact and separate the web **102**. In the embodiment shown in FIG. **13**, the web separator **125** is mounted at 90° with respect to a rectangular-shaped conveying belt **156**. However, in other embodiments, the web separator **125** can be mounted to the conveying belt **156** at any angle possible and capable of moving along any path possible as defined by the conveying belt **156**, such as triangular, circular and other paths as described above. In other embodiments, the web separator **125** can move toward the web **102** via a combination of devices or actuators, including without limitation the aforementioned devices and actuators.

The embodiments illustrated in FIGS. **1–13** and especially FIGS. **1–3** and **6–8**, show the web separator **125** contacting the web **102** against a surface of the first winding roll **106**. However, in some embodiments, the web separator **125** presses the web **102** against one or more fingers, plates, spheres, and any other elements against which the web separator **125** can press instead of or in addition to pressing the web **102** against the roll **106**.

The embodiment best illustrated in FIG. **3** shows the web separator **125** comprising fingers **130**, bases **133**, and tips **132** having recesses **138**. However, the web separator **125** need not be comprised of a plurality of web separation fingers **130** with resilient tips **132** (whether or not having recesses **138** in the tips to accommodate the high friction surfaces **134** of the first winding roll **106**). Furthermore, the web separator **125** can make minor or brief contact with the web **102** sufficient to accelerate the web **102** to the breaking point, without the web **102** being required to slip on a first winding roll **106** in order to separate. In some embodiments, the web separator **125** can instead comprise a plurality of sharp web separation fingers **130**, elongated or otherwise, for extension into grooves in the first winding roll **106**. In other embodiments, the sharp or otherwise web separation fingers **130** can extend into grooves in any surface adjacent the advancing web **102**, whether a winding roll, belt or other surface capable of advancing or supporting the web **102**. In still other embodiments, the web separation fingers **130** can be one or more bars, rods, plates, or other elements that press the web **102** against a stationary or moving surface. In yet other embodiments, the sharp or otherwise web separation fingers **130** can merely extend toward, into or through the advancing web **102** to separate the web **102**, whether perforated or not, without the use of any first winding surface **106**. Such web separation fingers **130** can be sharp or can otherwise act as blades against the web **102** and/or first winding surface **106** in order to cut the web **102**, if desired. Additionally, in still other embodiments, the first winding roll **106** can be equipped with rotating blades or protrusions that move toward the web **102** at a velocity at least equal to that of the web **102** to engage the fingers **130** of the web separator **125**, the fingers **130** functioning as anvils. Alternatively, the blades of the first winding roll **106** can run near or adjacent the advancing web **102**, and the fingers **130** functioning as anvils can move toward the web to contact the blades of the first winding roll **106** at a velocity at least equal to that of the advancing web **102**.

Furthermore, the resilient tip **132** of the web separation finger **130** need not rotate or follow a circular path to contact and separate the web **102**, but can follow one or more of a number of different paths, as explained above. The web separator **125** can follow any possible path as long as the web separator **125** is movable toward and away from an advancing stream of web at a velocity at least equal to that of the web **102** adjacent the web separator **125** at the time of web separation in order to separate the web **102**.

A number of alternative elements and structures can be employed for this purpose. By way of example only, the web separator **125** can comprise a roll adjacent the first winding roll **106** and rotatable about an axis at a speed greater than that of the advancing stream adjacent the web separator **125**. Such a roll can be moved in any conventional manner toward the advancing stream of web **102** to separate the web **102**. If desired, this roll can comprise one or more strips of resilient or rigid material of high or low friction extending transversely or longitudinally along the roll, or can have a continuous outer surface composed of a resilient or rigid material of high or low friction. In embodiments where the core support surface **110** and first winding roll **106** as depicted in FIGS. **1–13** are employed, this web separation roll **125** can instead be a cylindrical eccentric roll having grooves defining portions of the roll that can pass through the core support surface **110** to contact the web **102**. In still other embodiments, the web separator **125** can be a moving belt or wheel with paddles or fingers, or other types of protrusion extending into contact with the web **102** as needed.

In those embodiments in which a core support surface **110** and a web separator **125** are employed, these two devices do not necessarily need to cooperate (i.e. interdigitate; contact one another; move near, past, or through each other; or operate synchronously). These and any other structure capable of separating the web **102** by moving toward the web **102** at a velocity at least equal to that of a portion of the web **102** adjacent the first winding roll **106** can be employed as alternatives for the web separator **125** and, thus, can be employed without departing from the present invention.

The rolls described above can have a number of different structures, as stated above, including without limitation belts, wheels, stationary surfaces, stationary tracks having a plurality of rollers or wheels for conveying material, and any other conveying or supporting structure that performs the function of transporting, supporting, and/or winding the web **102**. In some embodiments, the first winding surface **106** has a plurality of alternating longitudinal strips of high friction surfaces **134** and low friction surfaces **136**; however, this need not be the case, but rather the first winding surface **106** can have one continuous outer surface of high or low friction including without limitation steel; aluminum; poly (tetrafloroethylene) (PTFE; Teflon®); rubber; emery cloth; wood, natural or otherwise; ultra-high molecular weight poly(ethylene); silicone; and any other surface capable of acting as at least an outer layer on the first winding surface **106** for transporting, supporting and/or winding the web **102**. The first winding surface **106** need not transport the web necessarily, but, if employed, provides a surface against which the web separator **125** can press the web **102** for the purpose of separating the web **102**. Alternatively, the web **102** can move through the winding area **101** without being directly adjacent any winding surface, in which case the tension in the web **102** is selected to be sufficient for a web separator **125** approaching, contacting and pulling the web **102** at a velocity at least equal to that of the running speed of the web **102** to separate the web **102**. Additionally, even if a first winding surface **106** is employed for advancing the web **102**, the web separator **125** need not cooperate (i.e. contact; move near, past or through; interdigitate; or operate synchronously) with this surface **106** in order to separate the web **102**. Thus, the above and any other structures capable of transporting and winding the web **102** are considered to fall within the spirit and scope of the present invention.

What is claimed is:

**1**. A method of winding a web onto a core in a rewinder, the rewinder winding a web of material adjacent at least one of a first winding roll, a second winding roll and a rider roll, at least two of the first, second, and rider rolls defining a winding nip in the rewinder, the method comprising:

moving the core onto at least one core support plate and toward the web running into the winding nip;

moving a web separation bar toward the web at a velocity at least equal to that of a portion of the web adjacent the first winding roll;

accelerating the web separation bar to a velocity at least 125% of that of the web;

pressing the web between the web separation bar and a surface on an opposite side of the web;

separating the web into a leading edge and a trailing edge;

moving the web separation bar away from the web; and

winding the leading edge around the core.

**2**. The method as claimed in claim **1**, wherein pressing the web includes pressing the web between the web separation bar and a surface of the first winding roll.

**3**. The method as claimed in claim **1**, wherein pressing the web includes pressing the web between the web separation bar and a surface located between the first winding roll and the web.

**4**. The method as claimed in claim **1**, wherein moving the web separation bar toward the web includes moving the web separation bar via a linear actuator.

**5**. The method as claimed in claim **1**, wherein moving the web separation bar toward the web includes moving the web separation bar via a conveying belt.

**6**. The method as claimed in claim **1**, further comprising perforating the web.

**7**. The method as claimed in claim **1**, further comprising accelerating the web at the web separation bar by contact of the web separation bar against the web.

**8**. The method as claimed in claim **1**, further comprising increasing tension in the web upstream of the web separation bar.

**9**. The method as claimed in claim **1**, further comprising separating the web upstream of the web separation bar.

**10**. The method as claimed in claim **1**, wherein a first point of contact is defined between the first winding roll and the core, and a second point of contact located downstream of the first point of contact is defined between the first winding roll and the web separation bar; the method further comprising increasing tension in the web between the first and second web contact points.

**11**. The method as claimed in claim **10**, further comprising separating the web between the first and second web contact points.

**12**. The method as claimed in claim **1**, further comprising moving the core off of the core support plate to roll upon the second winding roll.

**13**. The method as claimed in claim **1**, wherein the web separation bar comprises a plurality of tips; and moving the web separation bar includes moving the plurality of tips adjacent the at least one core support plate.

**14**. The method as claimed in claim **1**, further comprising accelerating the web separation bar to a velocity at least equal to that of the web.

**15**. The method as claimed in claim **1**, further comprising accelerating the web separation bar to a velocity at least 150% of that of the web.

**16**. The method as claimed in claim **1**, further comprising moving a web separator defined at least in part by the web separation bar toward the web at a velocity at least equal to that of the web.

**17**. A method of winding a web onto a core in a web rewinder, including a winding nip defined at least partially by a first winding roll, the method comprising:

passing the web over a surface of the first winding roll;

moving the core adjacent the web along at least one core support plate adjacent the first winding roll;

moving a web separator toward the web at a velocity at least equal to that of a portion of the web adjacent the first winding roll;

accelerating the web separator to a velocity at least 125% of that of the web;

pressing the web between the web separator and the first winding roll; and

separating the web.

**18**. The method as claimed in claim **17**, wherein moving the web separator toward the web includes moving the web separator via a linear actuator.

**19**. The method as claimed in claim **17**, wherein moving the web separator toward the web includes moving the web separator via a conveying belt.

**20**. The method as claimed in claim **17**, further comprising releasing the web compressed between the web separator and the first winding roll.

**21**. The method as claimed in claim **17**, further comprising winding the web onto the core as the core moves toward the winding nip.

**22**. The method as claimed in claim **17**, further comprising moving the core off of the at least one core support plate for continued winding of the web onto the core in the winding nip.

**23**. The method of claim **17**, further comprising perforating the web.

**24**. The method as claimed in claim **17**, further comprising moving the core onto the at least one core support plate substantially simultaneously to moving the web separator toward the web.

**25**. The method as claimed in claim **17**, further comprising winding the web in a winding nip, defined by a first winding roll, a second winding roll and a rider roll.

**26**. The method as claimed in claim **17**, wherein the web separator has a plurality of fingers, bases and tips; the method further comprising moving the fingers between and through the at least one core support plate as the web separator approaches the web.

**27**. The method as claimed in claim **17**, further comprising accelerating the web separator to a velocity at least equal to that of the web.

**28**. The method as claimed in claim **17**, further comprising accelerating the web separator to a velocity at least 150% of that of the web.

**29**. The method as claimed in claim **17**, further comprising accelerating the web at the web separator by contact between the web separator and the web.

**30**. The method as claimed in claim **17**, further comprising increasing tension in the web upstream of the web separator by contact of the web with the web separator.

**31**. The method as claimed in claim **17**, further comprising separating the web up stream of the web separator.

**32**. The method as claimed in claim **17**, wherein a point of contact is defined as the point where the web separation bar contacts the first winding roll; the method further comprising increasing tension in the web upstream of the web contact point.

**33**. The method as claimed in claim **32**, further comprising separating the web upstream of the point of contact.

**34**. An apparatus capable of winding a web onto a core in a winding nip, the apparatus comprising:

a first winding roll at least partially defining the winding nip, the web running adjacent the first winding roll;

a core support plate on which the core is received and moved toward the winding nip; and

a web separation bar adjacent the first winding roll, the web separation bar movable in a non-transverse direction to the web into contact with the web at a velocity at least equal to that of the web, wherein the web separation bar is movable into and out of pressing relationship with the web via the use of a conveying belt.

**35**. The apparatus as claimed in claim **34**, wherein the core support plate is one of a plurality of core support plates onto which the core is guided toward the web.

**36**. The apparatus as claimed in claim **34**, wherein the core support plate is curved.

**37**. The apparatus as claimed in claim **34**, wherein the web separation bar is comprised of a plurality of tips which are movable to contact the web.

**38**. The apparatus as claimed in claim **37**, wherein the tips are composed of a deformable and resilient material.

**39**. The apparatus as claimed in claim **37**, wherein the first winding roll has alternating annular rings of high and low friction surfaces.

**40**. The apparatus as claimed in claim **37**, wherein the tips have recesses.

**41**. The apparatus as claimed in claim **34**, wherein the winding nip is defined by a first winding roll and a second winding roll.

**42**. The apparatus as claimed in claim **34**, wherein the winding nip is defined by a first winding roll, a second winding roll and a rider roll.

**43**. The apparatus as claimed in claim **34**, further comprising a web separator that is defined at least in part by the web separation bar.

**44**. The apparatus as claimed in claim **43**, wherein the web separator has a plurality of fingers, bases and tips.

**45**. The apparatus as claimed in claim **34**, wherein the web separation bar is rotatable into and out of pressing relationship with the web.

**46**. The apparatus as claimed in claim **34**, wherein the web separation bar is movable into and out of pressing relationship with the web via the use of a linear actuator.

**47**. The apparatus as claimed in claim **34**, wherein the web separation bar is movable to accelerate to a substantially similar velocity as that of the web.

**48**. The apparatus as claimed in claim **34**, wherein the web separation bar is movable to accelerate to a velocity at least equal to that of the web.

**49**. The apparatus as claimed in claim **34**, wherein the web separation bar is movable to accelerate to a velocity at least 125% of that of the web.

**50**. The apparatus as claimed in claim **34**, wherein the web separation bar is movable to accelerate to a velocity at least 150% of that of the web.

**51**. A rewinding apparatus for winding a web, comprising:

a first winding surface that transports and supports the web;

a core support surface on which cores are guided adjacent the first winding surface toward the web; and

a web separator adjacent the first winding surface and movable into and out of pressing relationship with the web at a velocity at least equal to that of the web, wherein the web separator is movable to contact the web via a linear actuator.

**52**. The apparatus as claimed in claim **51**, wherein the core support surface is comprised of a plurality of plates.

**53**. The apparatus as claimed in claim **51**, wherein the core support surface is curved.

**54**. The apparatus as claimed in claim **51**, wherein the first winding surface is a roll.

**55**. The apparatus as claimed in claim **51**, wherein the first winding surface is a conveying belt.

**56**. The apparatus as claimed in claim **51**, wherein the web separator has a plurality of bases, fingers and tips.

**57**. The apparatus as claimed in claim **51**, wherein the web separator is defined at least in part by a web separation bar.

**58**. The apparatus as claimed in claim **57**, wherein the web separation bar is defined at least in part by a plurality of tips.

**59**. The apparatus as claimed in claim **58**, wherein the tips are composed of a deformable and resilient material.

**60**. The apparatus as claimed in claim **51**, wherein the web separator is rotatable toward and away from the web.

**61**. The apparatus as claimed in claim **51**, wherein the web separator is movable to accelerate to a velocity at least equal to that of the web.

**62**. The apparatus as claimed in claim **51**, wherein the web separator is movable toward the web at a velocity at least 125% of that of the web.

**63**. The apparatus as claimed in claim **51**, wherein the web separator is movable toward the web at a velocity at least 150% of that of the web.

**64**. The apparatus as claimed in claim **51**, wherein the web separator is movable to contact the web via a conveying belt.

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